



# **Armed Forces College of Medicine AFCM**



# Hypothalamus and posterior pituitary

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## ***INTENDED LEARNING OBJECTIVES (ILOs)***



By the end of this lecture the student will be able to:

- ✓ Describe functional relationships between the hypothalamus and the pituitary gland
- ✓ List the hormones that are released from the posterior pituitary gland.
- ✓ Summarize the function and regulation of vasopressin hormone.
- ✓ Summarize the functions and regulation of oxytocin hormone.

# Lecture Plan



**Part 1:** Introduction hypothalamus and pituitary gland

**Part 2:** Main Lecture topics

- o Antidiuretic hormone
- o Oxytocin

**Part 3:** Summery

**Lecture Quiz**

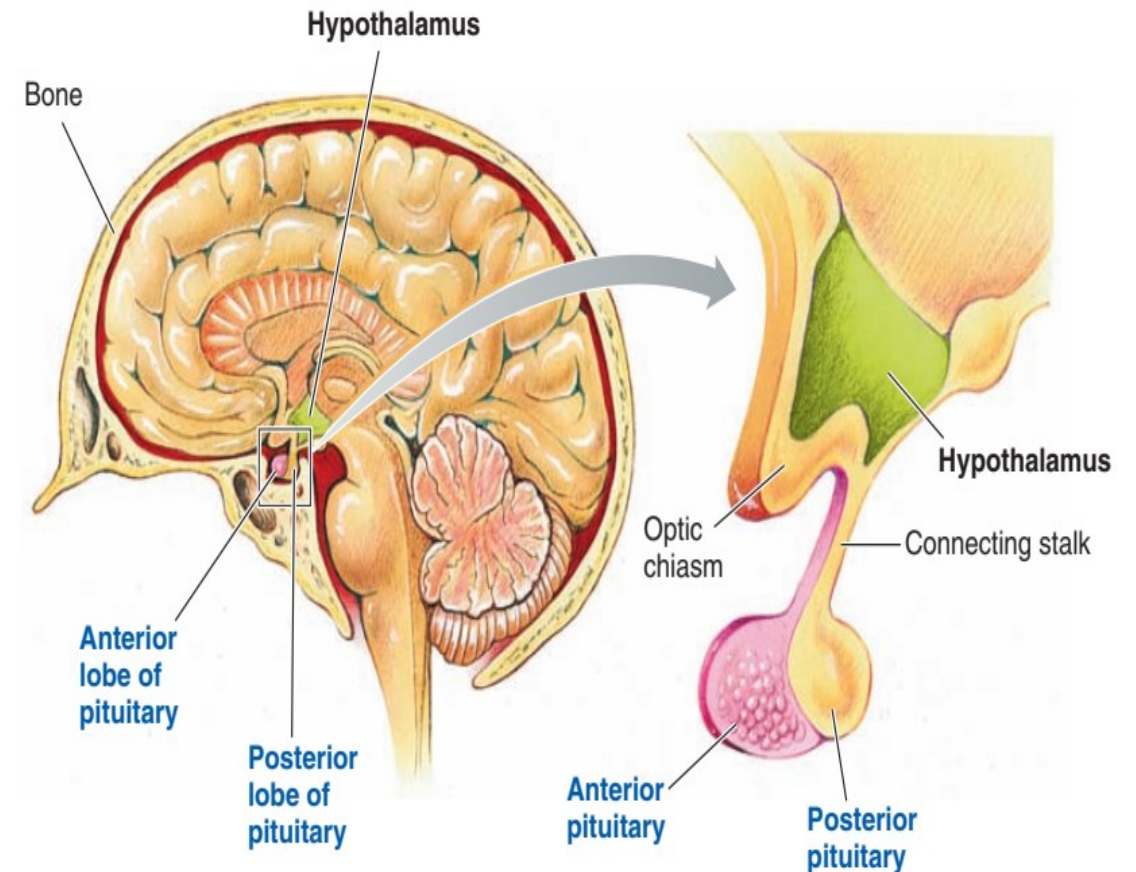


# *Hypothalamus and pituitary gland*



Hypothalamus: This is the main interface between the nervous system and the endocrine system

Connected to the pituitary gland by pituitary stalk



Lauralee Sherwood, Human Physiology, From Cells to Systems, 2016

# Hypothalamus and pituitary gland

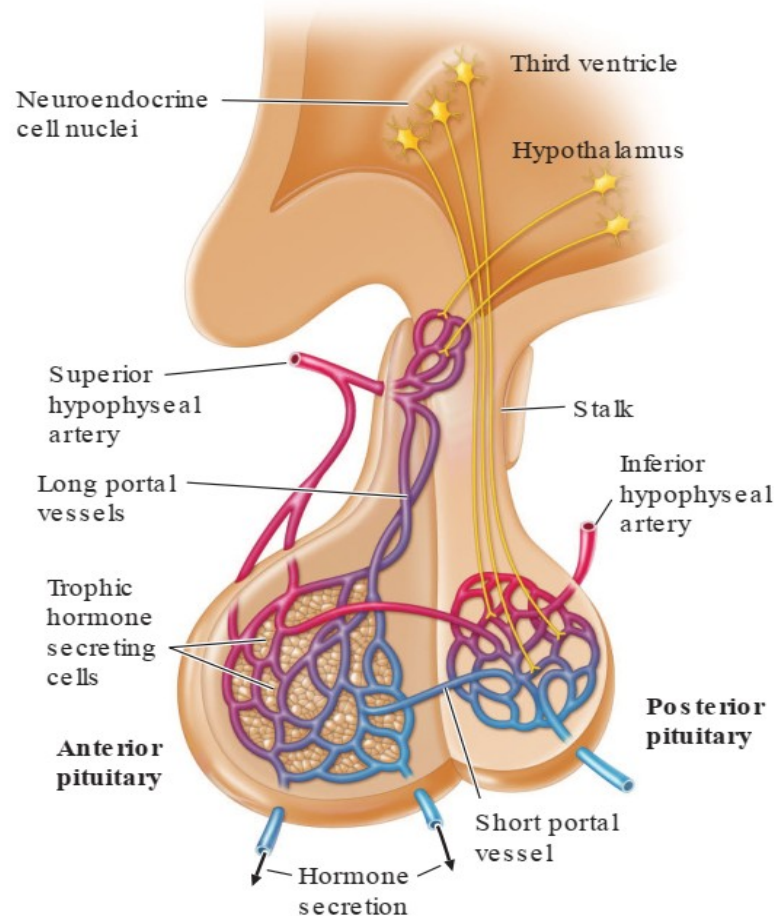


## Anterior lobe (adenohypophysis):

It consists of glandular epithelial tissue

Connected to the hypothalamus by vascular connection (Hypothalamic-hypophyseal portal circulation)

Synthesize hormones



HARRISON'S ENDOCRINOLOGY, 4th Edition, 2017

Endocrine & Genitourinary Module

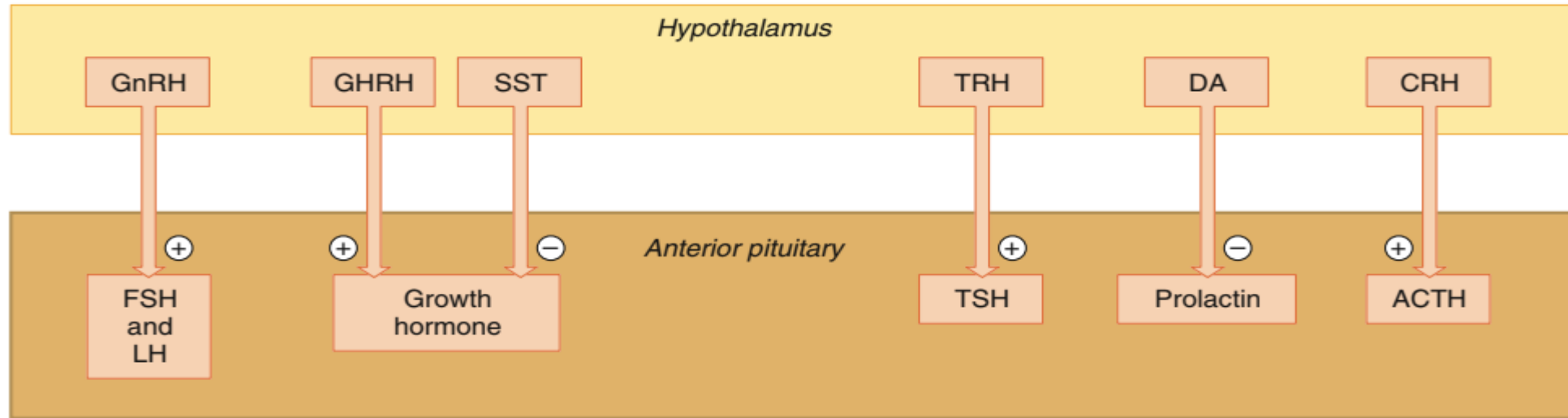
## Posterior lobe (neurohypophysis):

composed of nervous tissue

Connected to the hypothalamus by nervous connection (Hypothalamic-hypophyseal tract)

Release the stored hormones synthesized by hypothalamus

# Hypothalamus and pituitary gland

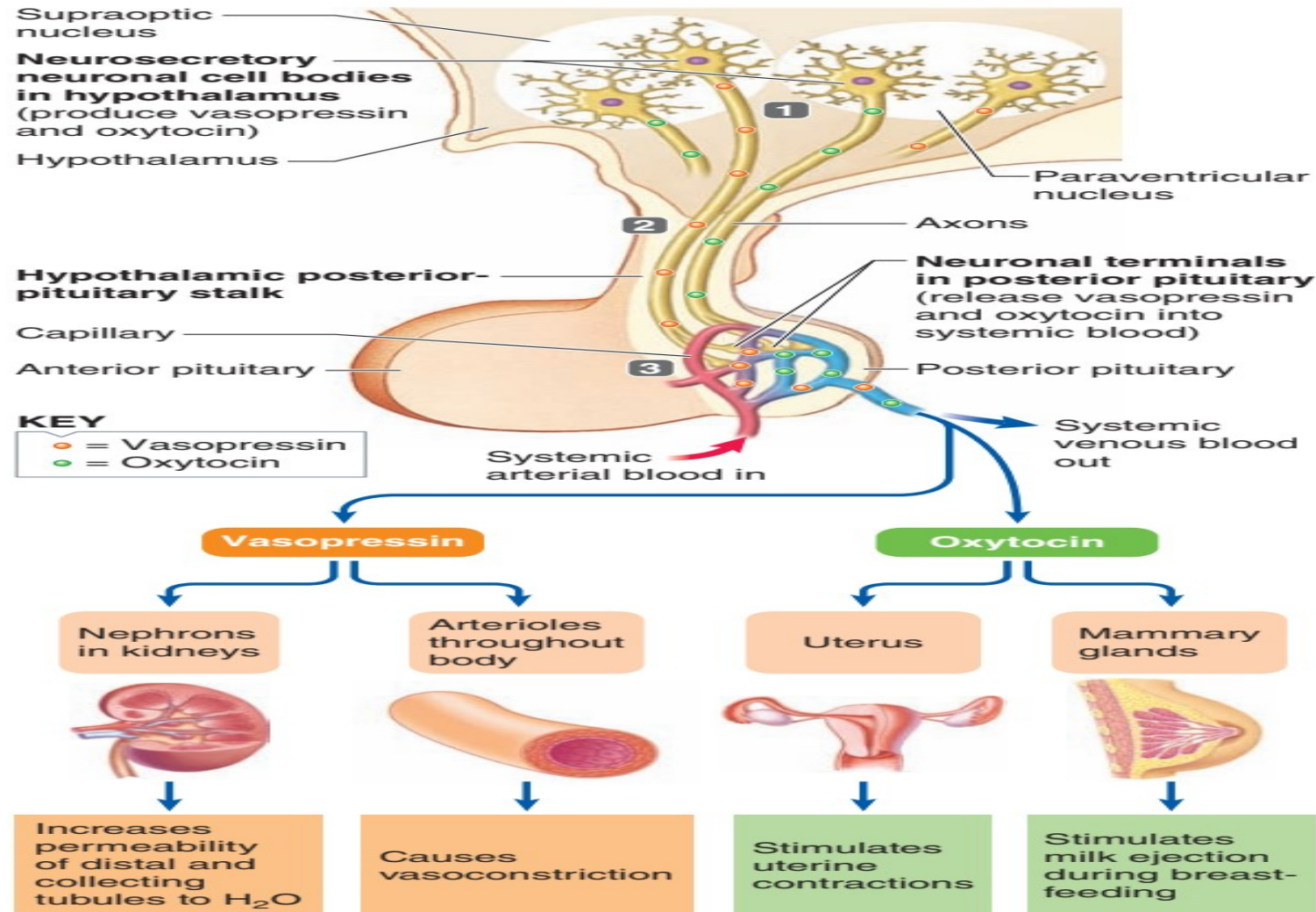


Major known hypophysiotropic hormones	Major effect on anterior pituitary
Corticotropin-releasing hormone (CRH)	Stimulates secretion of ACTH
Thyrotropin-releasing hormone (TRH)	Stimulates secretion of TSH
Growth hormone-releasing hormone (GHRH)	Stimulates secretion of GH
Somatostatin (SST)	Inhibits secretion of GH
Gonadotropin-releasing hormone (GnRH)	Stimulates secretion of LH and FSH
Dopamine (DA)*	Inhibits secretion of prolactin

VANDER'S HUMAN PHYSIOLOGY: THE  
MECHANISMS OF BODY FUNCTION,  
FOURTEENTH EDITION , 2016



# Posterior pituitary gland



Lauralee Sherwood, Human Physiology, From Cells to Systems, 2016

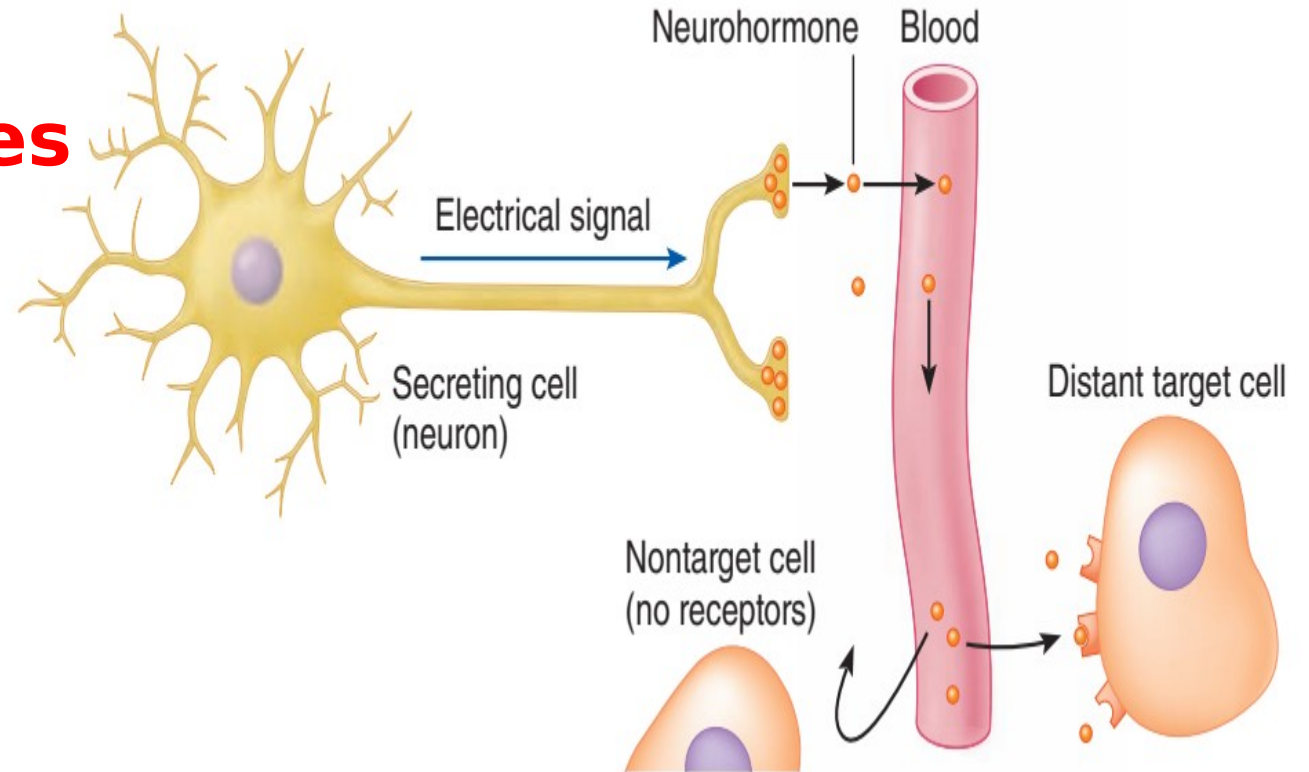


# *Posterior pituitary gland hormones*



## **Oxytocin and vasopressin are typical neural hormones**

What is the meaning of neural hormones?



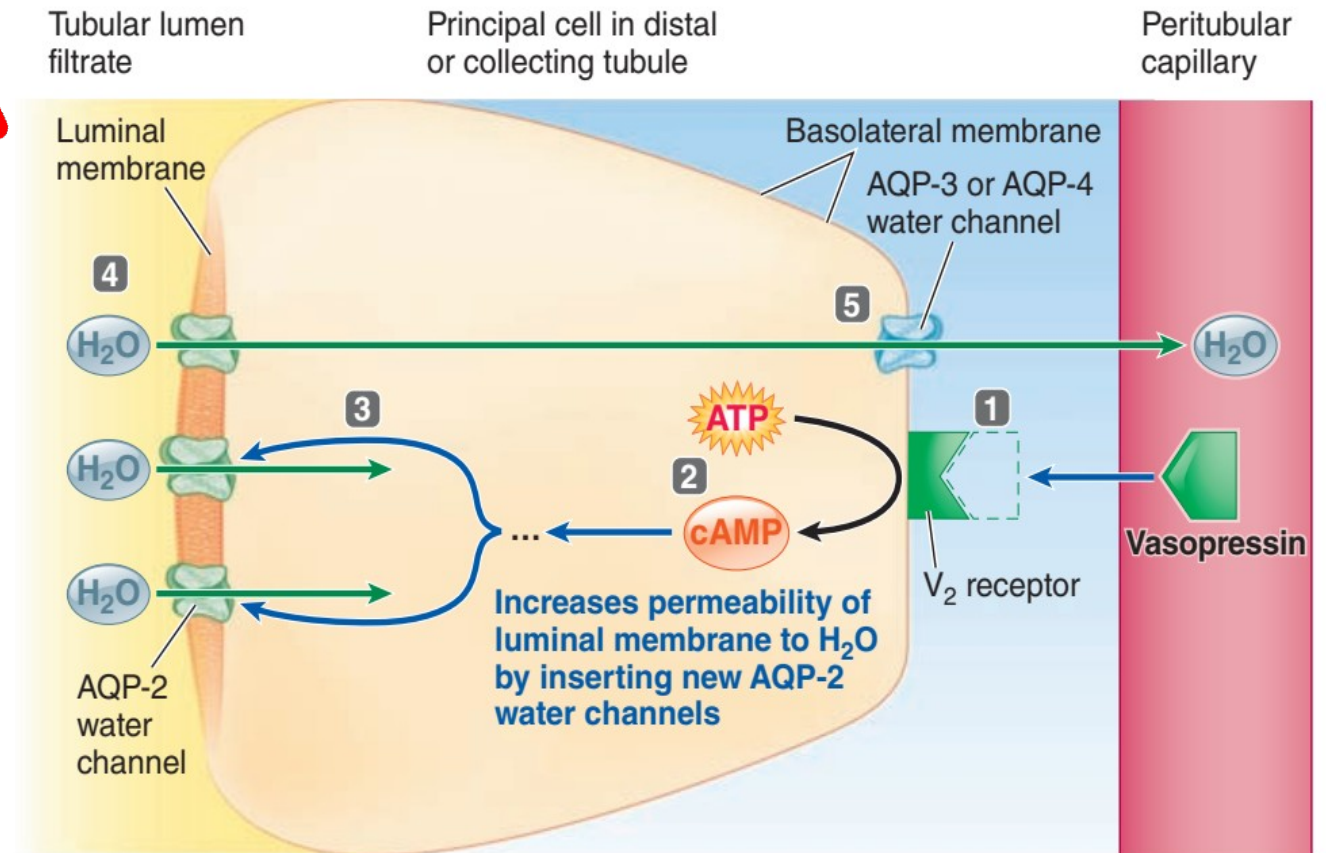
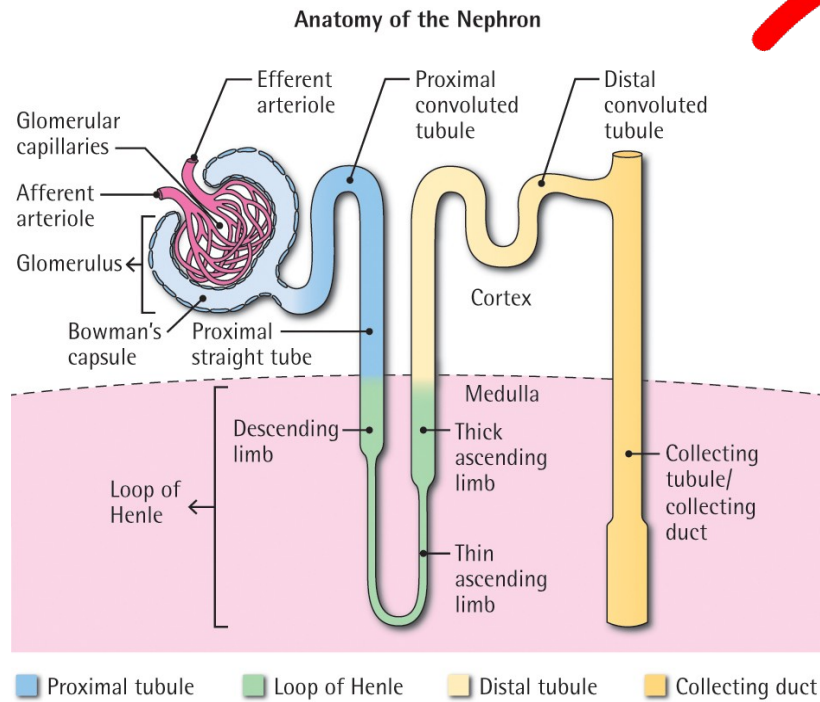
Lauralee Sherwood, Human Physiology, From Cells to Systems, 2016

# Antidiuretic hormone (Vasopressin)



## Action:

### 1- Renal effect:



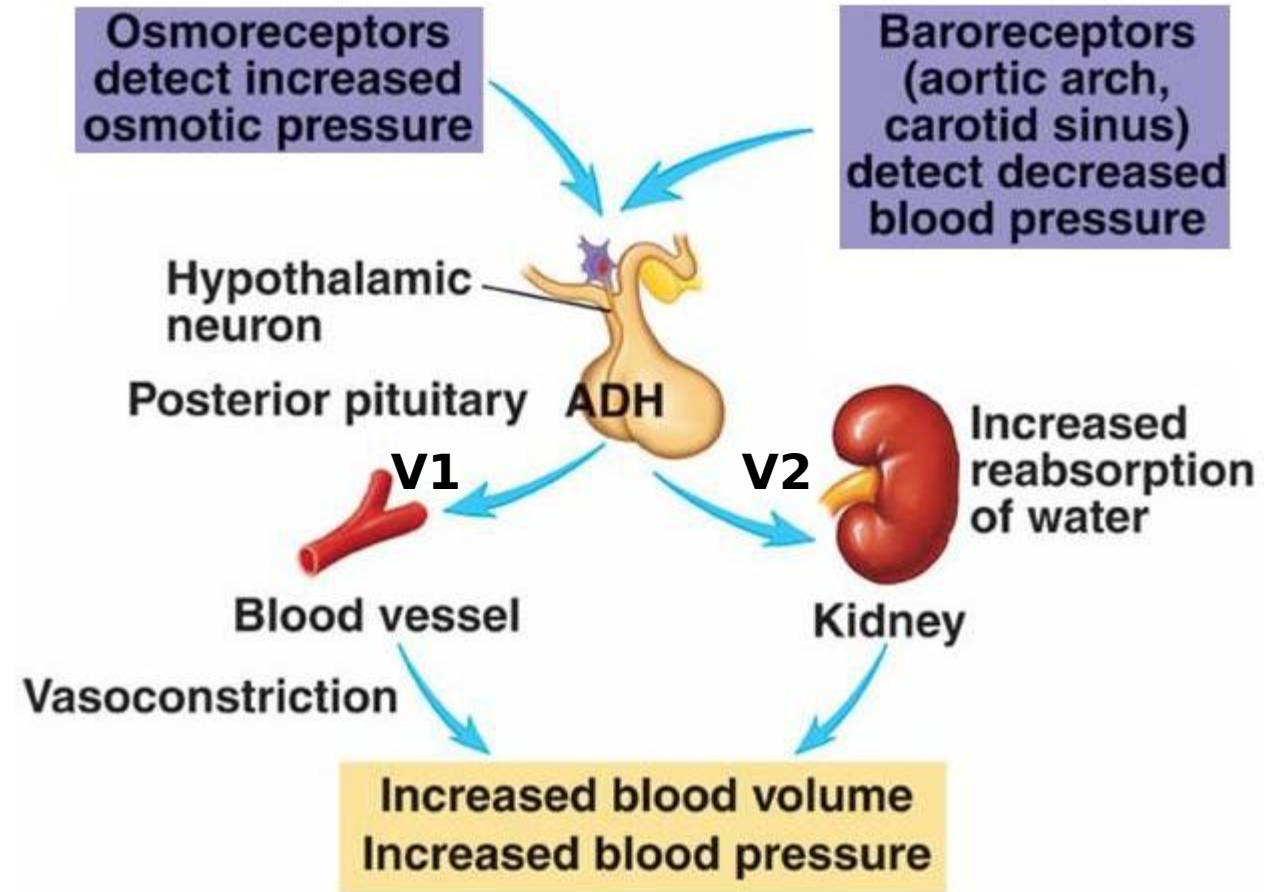
Lauralee Sherwood, Human Physiology, From Cells to Systems, 2016

# *Antidiuretic hormone (Vasopressin)*



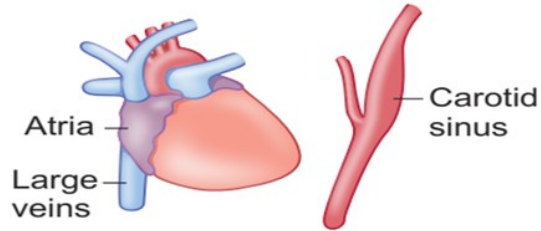
## Action:

**2- Contraction of vascular smooth muscle:**

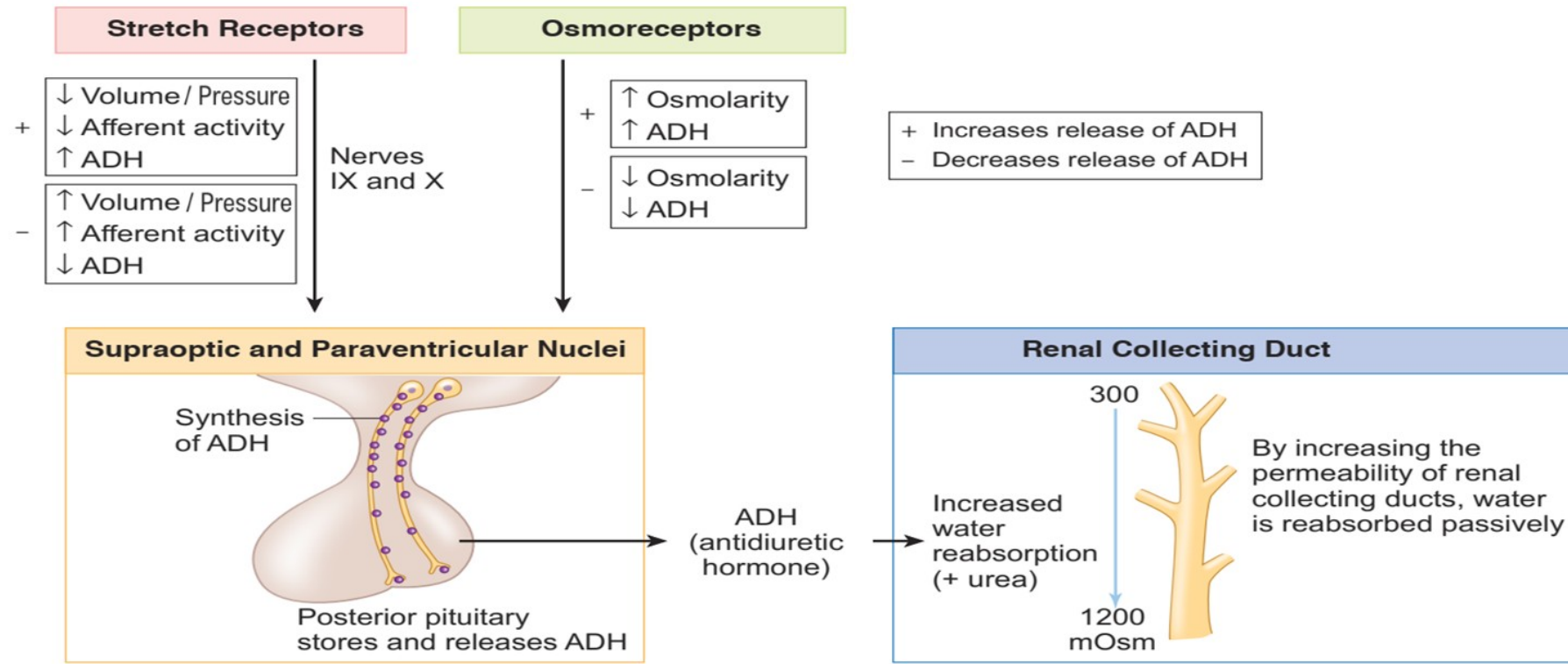


Lauralee Sherwood, Human Physiology, From Cells to Systems, 2016

# Antidiuretic hormone (Vasopressin)



## Regulation:



## *Antidiuretic hormone (Vasopressin)*



### Regulation:

- Pain, nausea, hypoglycemia, and various drugs (e.g., nicotine, opiates, antineoplastic agents) all stimulate the secretion of ADH
- Ethanol,  $\alpha$ -adrenergic agonists, and ANP (Atrial natriuretic peptide) inhibit secretion of ADH



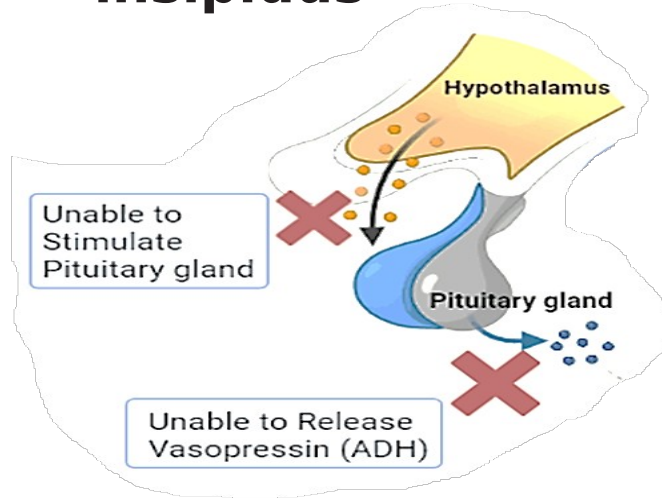
# Antidiuretic hormone (Vasopressin)



## Abnormalities:

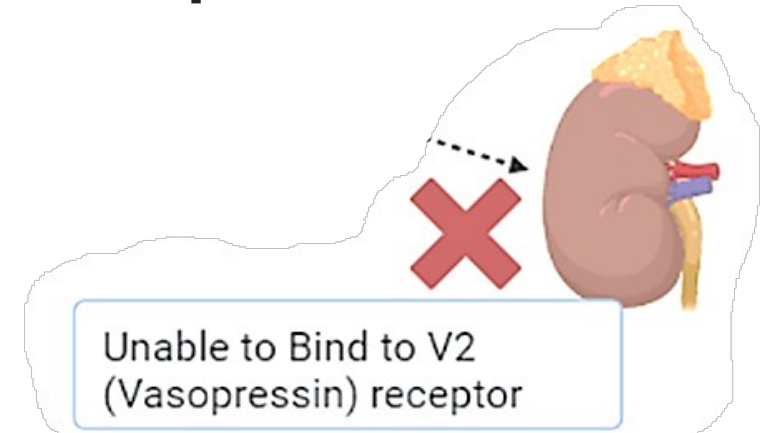
### 1. Diabetes Insipidus (DI):

#### A. Central (neurogenic) diabetes insipidus

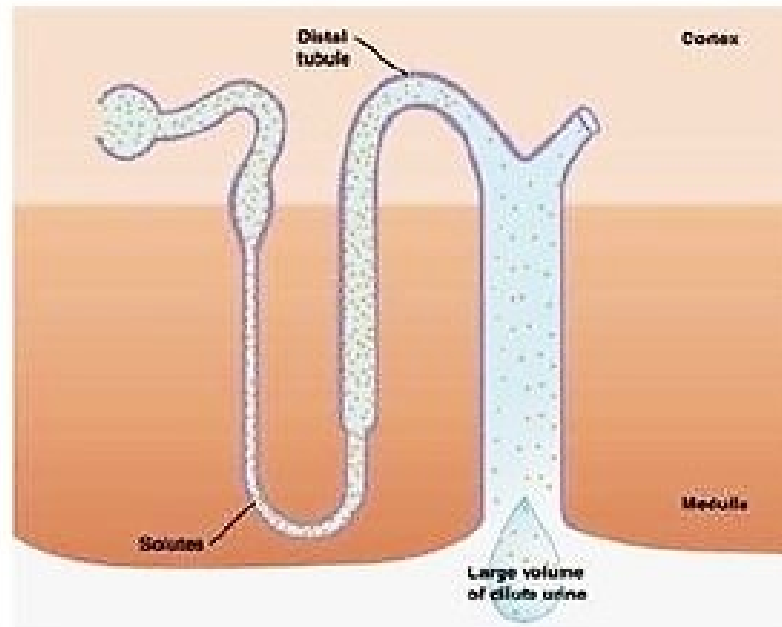


Plasma ADH level is **low**  
Urine osmolarity is **increased** following synthetic ADH injection

#### B. Nephrogenic diabetes insipidus



Plasma ADH level is **High**  
Urine flow and osmolarity is **not change** following synthetic ADH injection



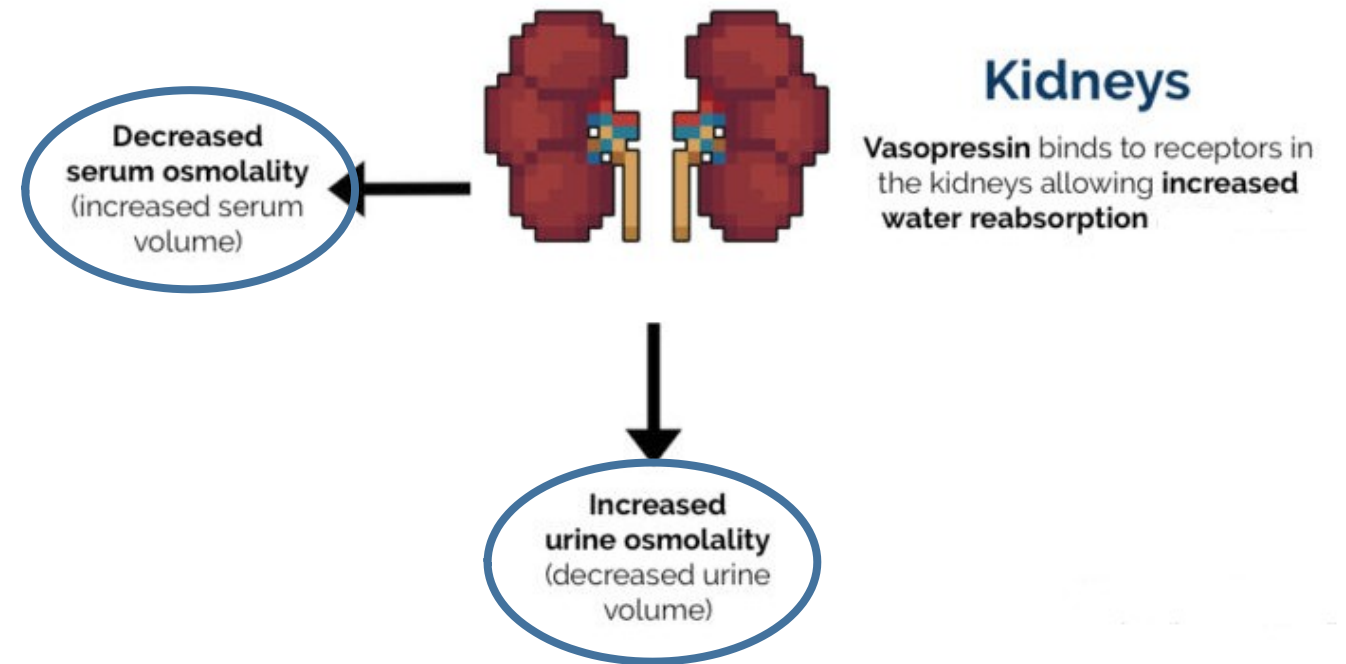
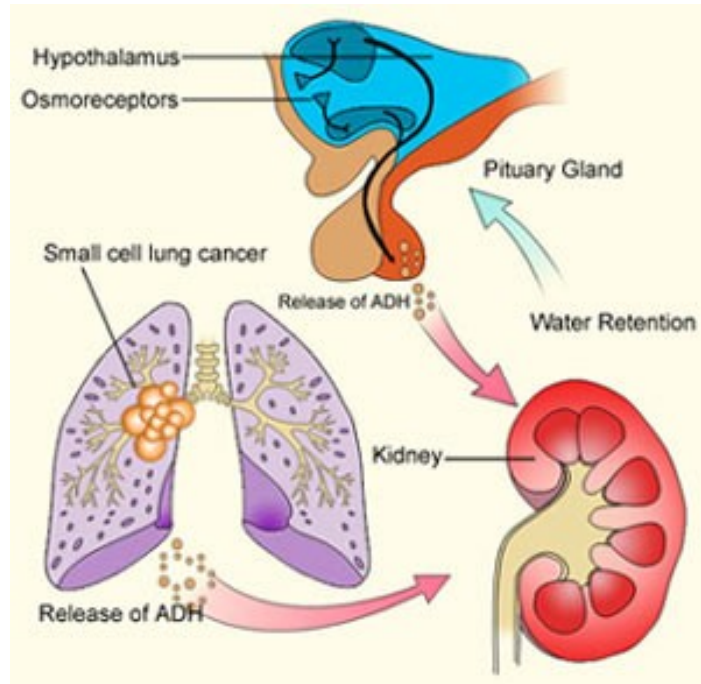


# *Antidiuretic hormone (Vasopressin)*



## Abnormalities:

### 2. Syndrome of inappropriate ADH secretion (SIADH):



## Complete:

Vasopressin act through V1 receptor to produce vasoconstriction while it binds to V2 receptor to increase water permeability from distal tubules and collecting ducts



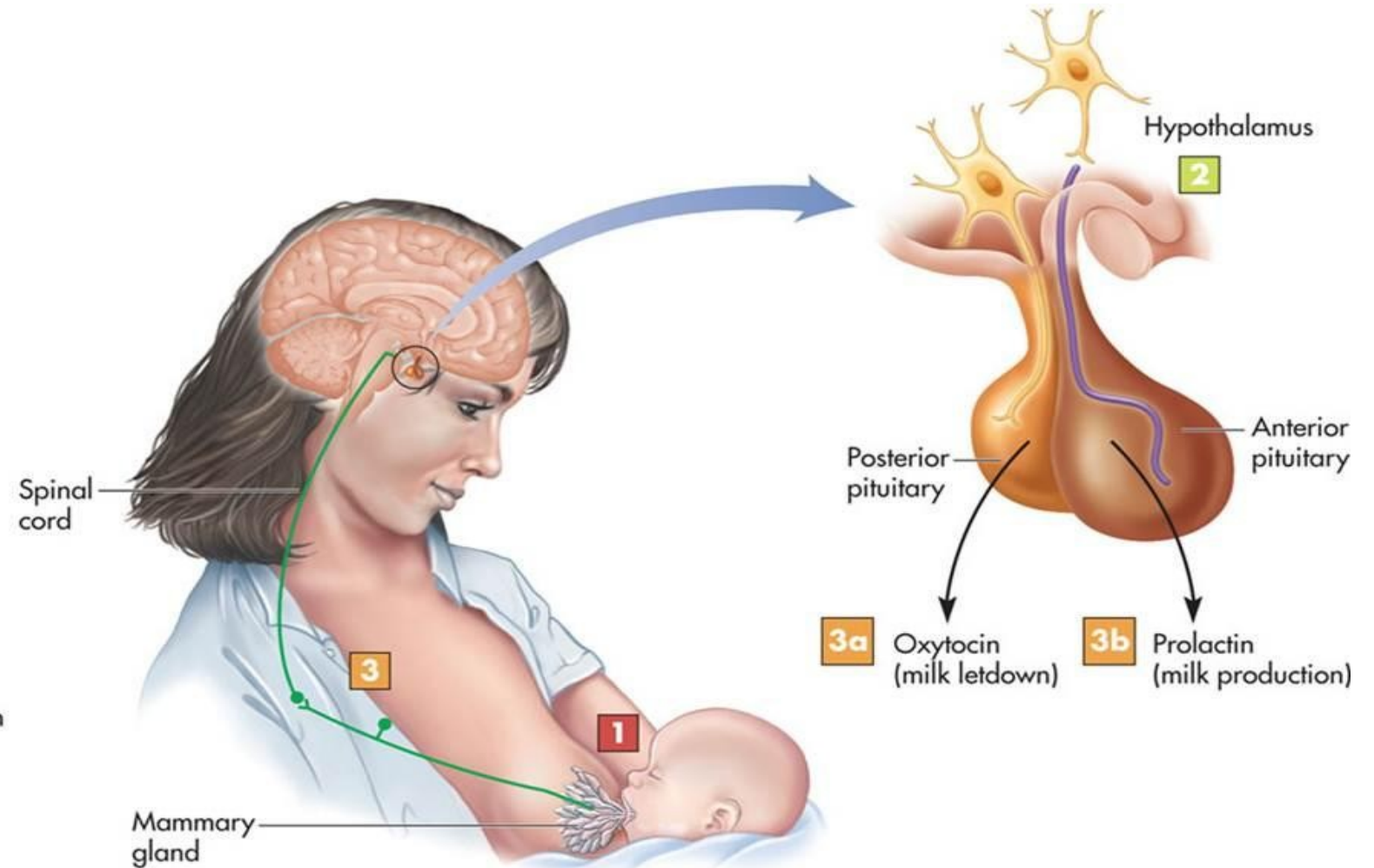
# Oxytocin



## Action:

### 1- Milk ejection:

- 1** Suckling stimulates nerves in the nipple and areola that travel to the hypothalamus.
- 2** In response, the hypothalamus stimulates the posterior pituitary to release oxytocin and the anterior pituitary to release prolactin.
- 3** Oxytocin stimulates lobules in the breast to let down (release) milk from storage. Prolactin stimulates additional milk production.



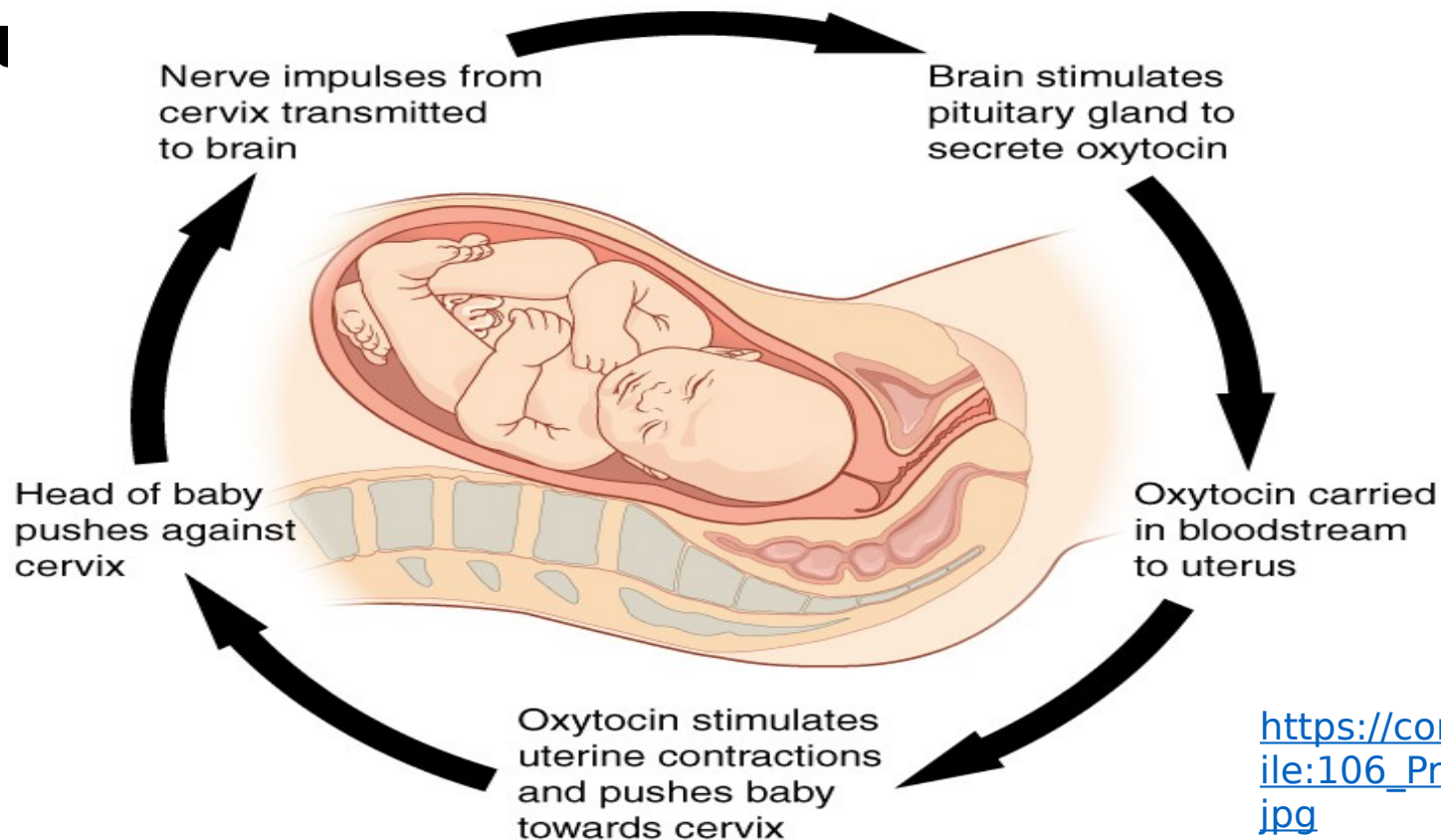
<http://pages.ucsd.edu/~mboyle/COGS11/COGS11-website/pdf-files/SU18-12-COGS11-Oxytocin%20-%20Is%20it%20truly%20the%20Love%20Hormone-black-kitten-group>

# Oxytocin



## Action:

## 2- Contraction of the smooth muscle of the pregnant



[https://commons.wikimedia.org/wiki/File:106\\_Pregnancy-Positive\\_Feedback.jpg](https://commons.wikimedia.org/wiki/File:106_Pregnancy-Positive_Feedback.jpg)



## Action:

### **3- Oxytocin may also cause contraction of the nonpregnant uterus**

These contractions facilitate sperm transport up the female genital tract to the uterine tubes, where fertilization normally takes place

### **4-Oxytocin has role in males**

Oxytocin level increases at the time of **ejaculation** which possibly causes increased contraction of the smooth muscle of the vas deferens, propelling sperm toward the urethra.

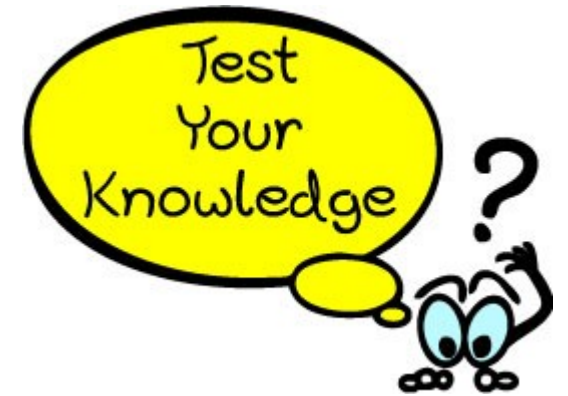


## Regulation:

*The secretion of oxytocin is increased by:*

- Suckling stimulates oxytocin release (suckling reflex).
- Genital tract stimulation during sexual intercourse in males and females.
- Dilatation of cervix during Labor through a positive feedback where release of the hormone causes an action which stimulates more of its own release.





## Complete:

Oxytocin acts primarily on the breasts and Pregnant uterus and  
Milk ejection Childbirth respectively and these action is triggered by  
increases in intracellular  $\text{Ca}^{2+}$  levels

## *Summary*



Neural connections run between the hypothalamus and the posterior lobe of the pituitary gland, and vascular connections between the hypothalamus and the anterior lobe of the pituitary.

The hormones secreted by the posterior pituitary gland are vasopressin and oxytocin. Vasopressin increases the permeability of the collecting ducts of the kidney to water, thus concentrating the urine and causes vasoconstriction. Oxytocin acts on the breasts (milk ejection) and the uterus (labor).



### **1- Which of the followings best describes anti-diuretic diuretic hormone (ADH) ?**

- a. Produced by the anterior lobe of the pituitary gland.
- b. Released by neurosecretion.
- c. Increased by a low plasma osmolarity.
- d. Increased by increased stimulation of atrial stretch receptors .
- e. Increasing water permeability of the proximal convoluted tubules.



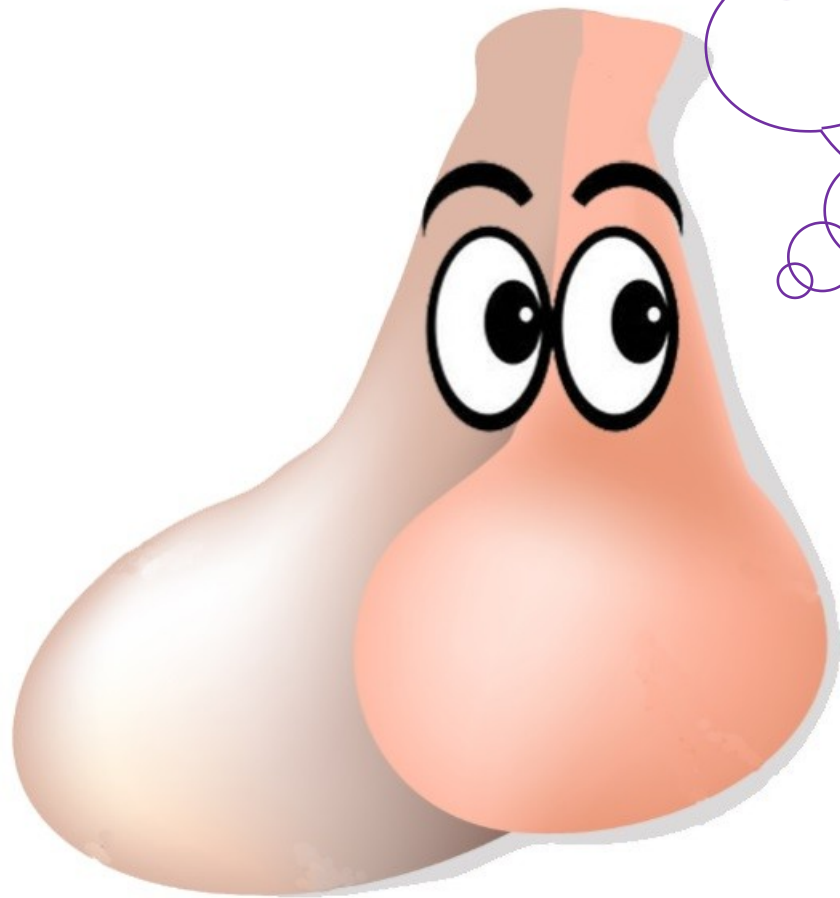
**2- which combination of hormones helps a mother to produce milk and nurse her baby?**

- a. Prolactin and calcitonin.
- b. Oxytocin and prolactin.
- c. Follicle-stimulating hormone and luteinizing hormone .
- d. Luteinizing hormone and oxytocin.
- e. Oxytocin, prolactin, and luteinizing hormone.

## ***SUGGESTED TEXTBOOKS***



1. Ganong's Review of Medical Physiology, twenty-fifth edition 2016, McGraw-Hill Education, chapter 17-18, from page 307 to 334
2. Guyton and Hall textbook of medical physiology, thirteenth edition 2016, Elsevier, chapter 76 , from page 939 to 950
3. Lauralee Sherwood Human Physiology: From Cells to Systems, Ninth edition 2016. CENGAGE, chapter 18, from page 646 to 652



***Thank  
You***